SHIP PRODUCTION COMMITTEE
FACILITIES AND ENVIRONMENTAL EFFECTS
SURFACE PREPARATION AND COATINGS
DESIGN/PRODUCTION INTEGRATION
HUMAN RESOURCE INNOVATION
MARINE INDUSTRY STANDARDS
WELDING
INDUSTRIAL ENGINEERING
EDUCATION AND TRAINING

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Ship Structural Cost Program

U.S. DEPARTMENT OF THE NAVY
CARDEROCK DIVISION,
NAVAL SURFACE WARFARE CENTER

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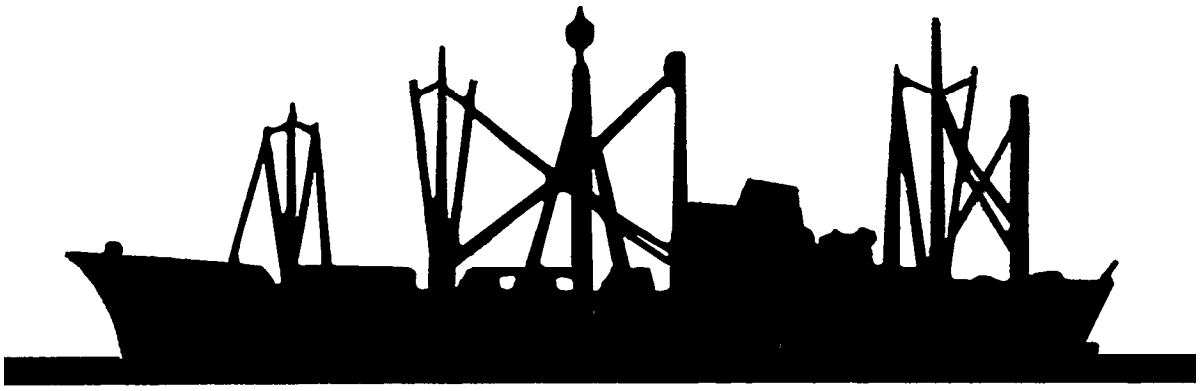

INSTITUTE FOR RESEARCH AND ENGINEERING FOR AUTOMATION AND PRODUCTIVITY IN SHIPBUILDING

IREAPS

SHIP STRUCTURAL COST PROGRAM

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Structural Engineer
David Taylor Naval Shipyard
Bethesda, Maryland

ABSTRACT

A ship-cost computer tool has been developed to estimate U.S. Naval Surface Ship construction for both shop and field Engineered Uniform Method and Standards and current Naval shipbuilding practices.

This procedure has been incorporated into the Ship Structural Cost Program (SSCP) to provide a means of rapidly estimating structural cost for ship structures. In this form SSCP provides a three-phase cost analysis where the shop erection and field installation procedures are included in Phases 2 and 3 and the panel/grillage shop assembly procedures are included in Phase 1.

The overall aim of our cost program is to develop a cost/weight tradeoff tool that has the capability of performing weight/cost optimization tradeoff studies. This information will become useful for Navy research and design communities in assessing high cost areas in the new ship construction, identification of optimum plate-beam combinations with respect to cost and/or weight, and the identification of materials and design details which tend to reduce cost.

DAVID W. TAYLOR NAVAL SHIP
RESEARCH AND DEVELOPMENT CENTER
Bethesda, Maryland 20084

SHIP STRUCTURAL COST PROGRAM

AUTOMATED COST ESTIMATING TOOL

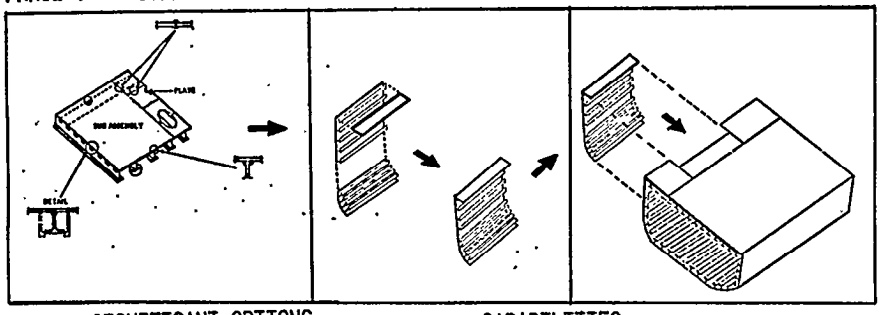
BASED ON NAVSEA

ENGINEERED UNIFORM METHODS & STANDARDS

FOR NAVAL SURFACE SHIP CONSTRUCTION

SHIP STRUCTURAL COST PROGRAM
SSCP

PHASE 1 - SUBASSEMBLY PHASE-2 SHOP ERECTION PHASE-3 FIELD INSTALLATION



SIGNIFICANT OPTIONS:
- GEOMETRY
- MONOHULL OR HIGH PERFORMANCE SHIP
- HULL AND/OR DECKHOUSE
- FLAT BAR STIFFENERS
- MATERIALS
  - MS, HTS, HY80, ALUM
- DETAILS

CAPABILITIES:
- MATERIAL COST STUDIES
- CONFIGURATION STUDIES
- COST/WEIGHT OPTIMIZATION

FUTURE IMPROVEMENTS:
- NEW DETAILS
- ALUM FIRE PROTECTION COSTS
- BALLISTIC PLATING COSTS
- WELD BONDS COSTS

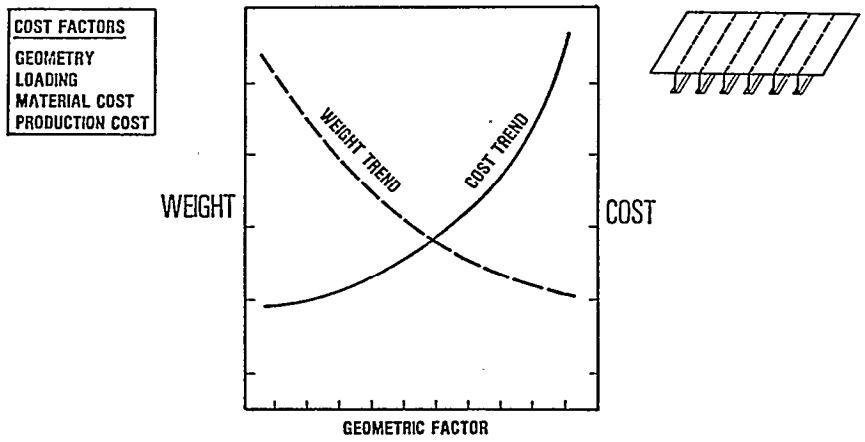
SHIP STRUCTURAL COST PROGRAM
SSCP

OBJECTIVES

LONG TERM
- DEVELOP COST/WEIGHT TRADE-OFF CAPABILITY FOR EFFICIENT USE OF MATERIAL & STRUCTURES

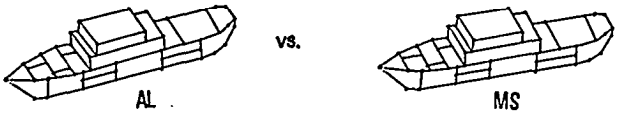
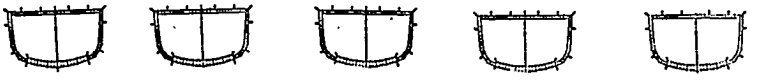
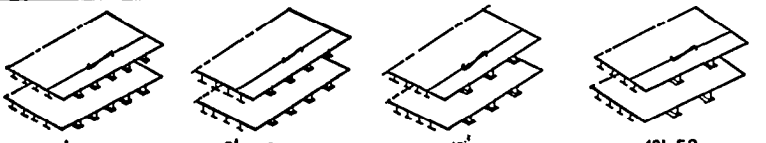
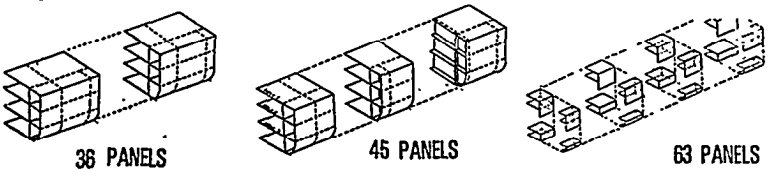
SHORT TERM
- DEVELOP A COST ESTIMATION PROGRAM FOR SURFACE SHIP STRUCTURES
- INCORPORATE THE CAPABILITY OF NAVY DESIGN PROGRAMS WITH THE COST PROGRAM TO PERFORM COST/WEIGHT OPTIMIZATION STUDIES
  - IMPROVE RELATIVE COST/WEIGHT TRADE-OFF CAPABILITY FOR R & D COMMUNITIES
  - PROVIDE NAVAL SHIPYARDS WITH COMPUTERIZED METHOD FOR COST ESTIMATING REPAIR & CONVERSION
  - EVALUATE HIGH COST AREAS OF SHIP CONSTRUCTION

COST/WEIGHT TRADE-OFF

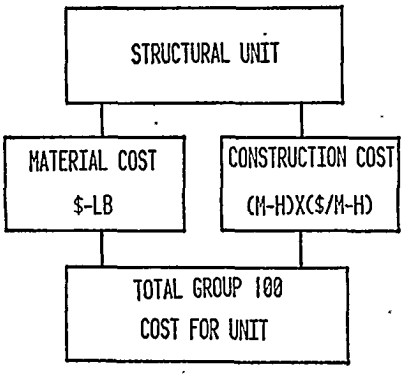


SSCP APPLICATIONS

[RELATIVE COST COMPARISONS]

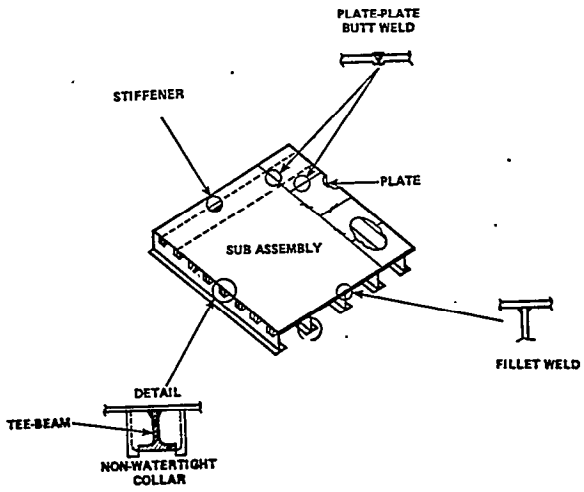
MATERIAL COST STUDY	
CONFIGURATION STUDY SCANTLINGS	
COST/WEIGHT OPTIMIZATION STUDY DECK SECTIONS	
CONFIGURATION STUDY MODULAR	

BASIC CONCEPT



PHASE 1- SHOP FABRICATION & WELDING

COST
LOFTING
LAYOUT
CUT & BURN
ROLLING
ASSEMBLY
WELDING



ENGINEERED
UNIFORM METHODS & STANDARDS

TITLE : STRUCTURAL-LOFT LAYOUT & MACHINE

- LOFT

  DEVELOP & BUILD TEMPLATES & DRAWINGS 1/10 SCALE (PLATES & SHAPES)

- LAYOUT

  TRANSFERRING TEMPLATES & DRAWINGS (PLATES & SHAPES)

TITLE : BURN FLAME CUT PRODUCTION

- PLATES

  TELEREX 90° CUT

  RADIAGRAPH BEVEL CUTTING

  SAW CUT ALUM

  SHEARING AL & ST

- STIFFENERS & DETAILS

  MANUAL HAND GUIDED

  90° CUT & BEVEL CUTTING

  SHEARING ALUM

ENGINEERED
UNIFORM METHODS & STANDARDS

TITLE, ROLLING OPERATIONS

PLATING MAN HOURS AREA FUNCTION OF PLATE THICKNESS & WIDTH OF ROLL

STIFFENERS- MAN HOURS AREA FUNCTION OF THE TYPE OF MACHINE OPERATION

TITLE : STRUCTURAL SHOP ASSEMBLY

- o PLATE ASSEMBLY
- 0 STIFFENER ASSEMBLY
- 0 DETAIL ASSEMBLY
- 0 VAC-U-BLAST
- 0 PNEUMATIC SERVICES
- O BURNING & WELDING SERVICES
- 0 CRANE SERVICES

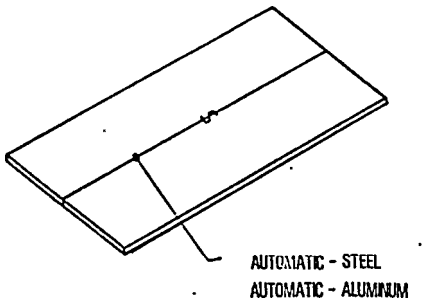
TITLE : WELDING , STRUCTURAL PRODUCTION

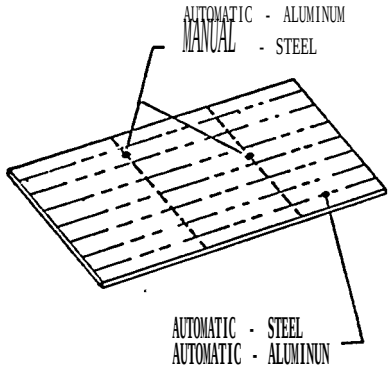
o MANUAL WELDING (MS. HTS.HY80)
SHIELDED METAL ARC .

o AUTOMATIC WELDING
SUBMERGED METAL ARC (MS,HTS)
GAS METAL ARC (ALUM)

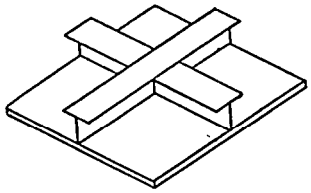
Q INSPECTION
A- NO N.D.T
B- BASIC N.D.T
C- FULL N.D.T

PLATE & STIFFENER WELDING

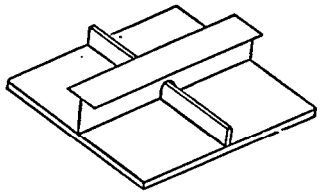




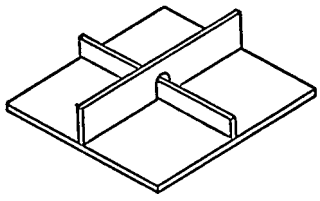
STIFFENER INTERSECTIONS



TEE-TEE



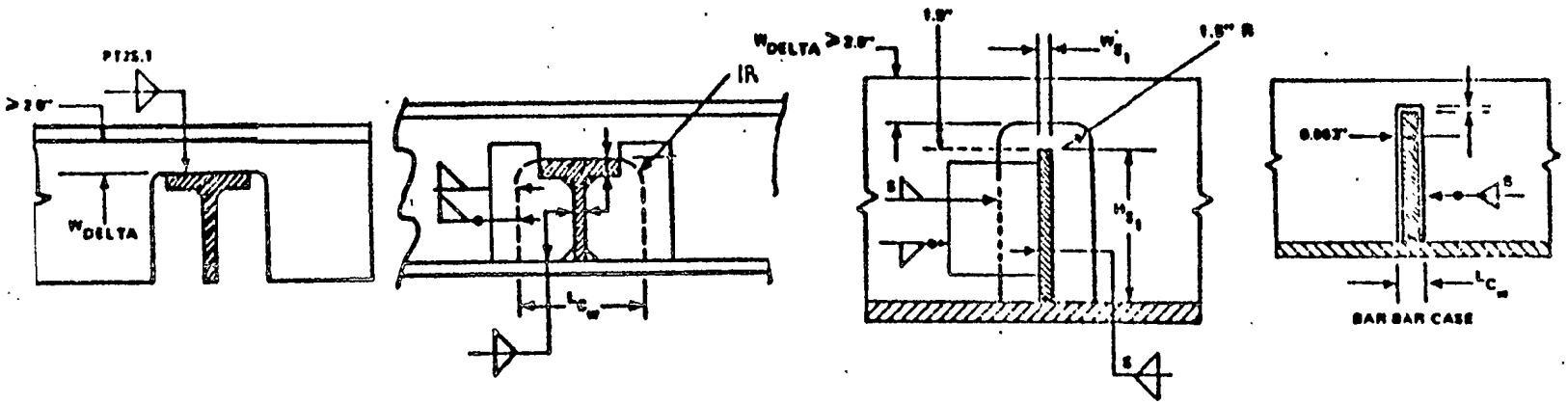
TEE-BAR

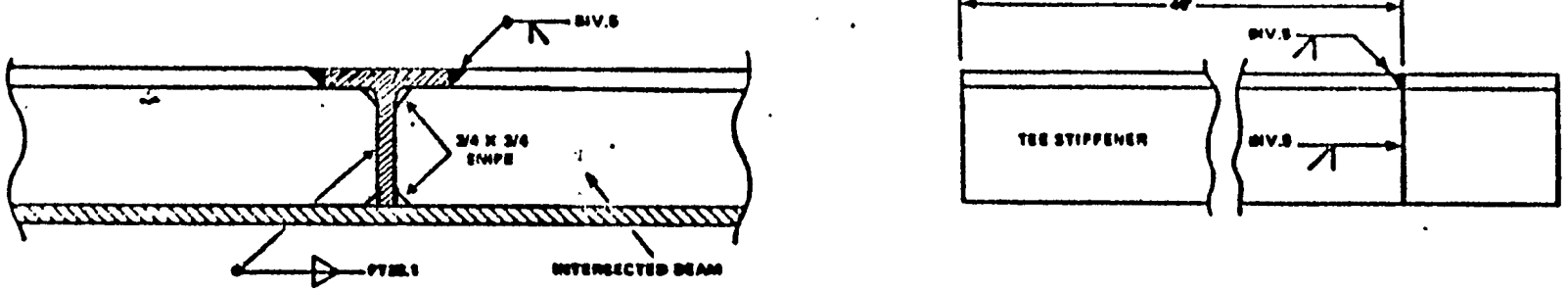


BAR-BAR

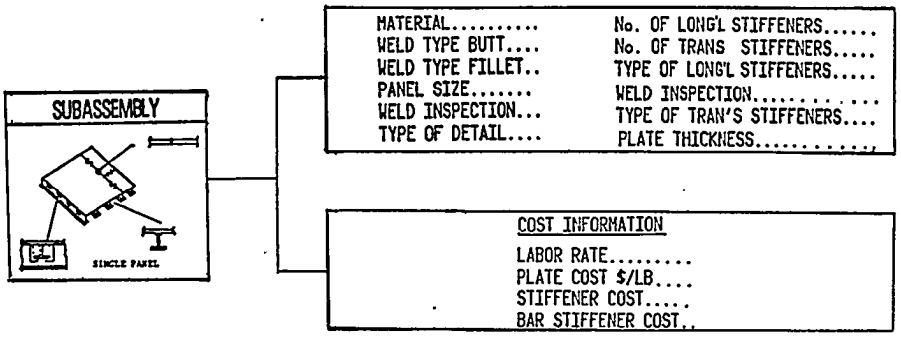
STIFFENER INTERSECTIONS DETAILS

-SAMPLE-

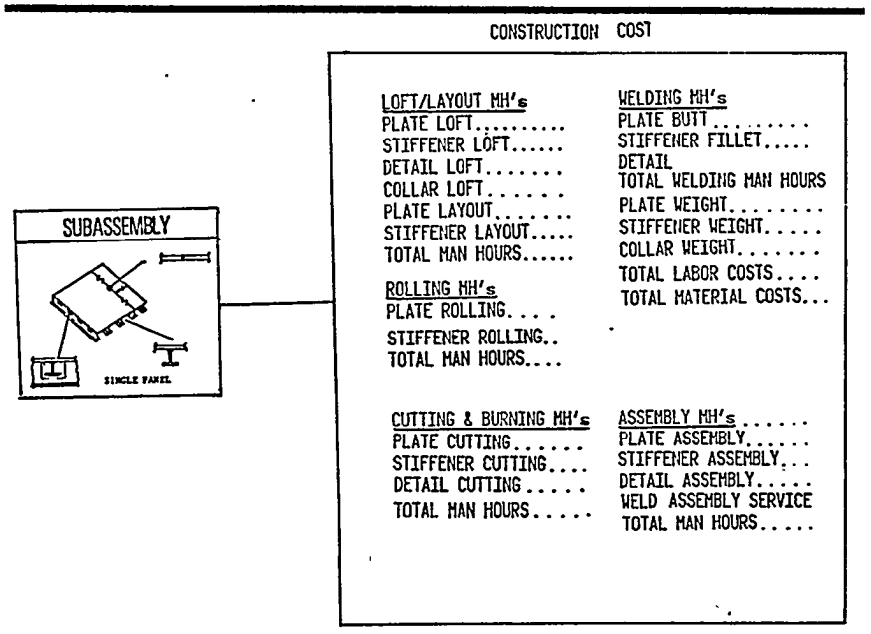




OUTPUT - PHASE 1



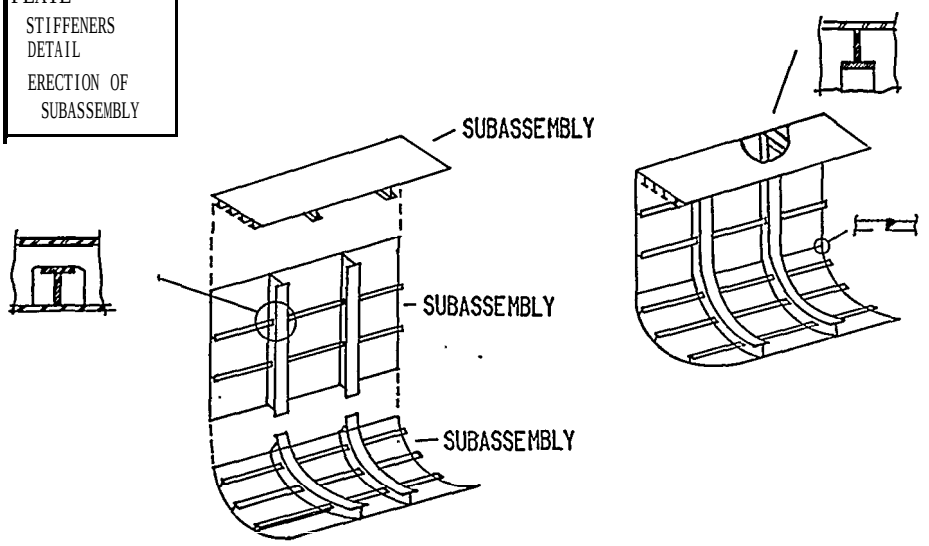
OUTPUT - PHASE 1



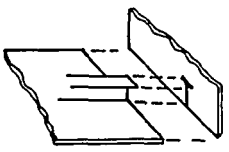
PHASE 2 - SHOP ERECTION

COST INFORMATION

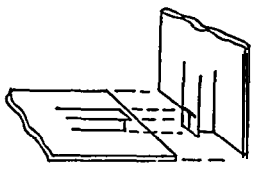
PLATE
STIFFENERS
DETAIL
ERECTION OF
SUBASSEMBLY



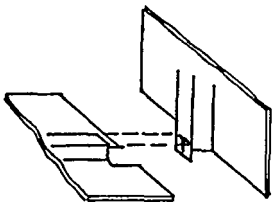
PAN EL JOINTS



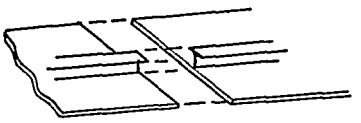
-STIFFENER BUTTED AGAINST
HATE



- END STIFFENER CUT
- STIFFENER BUTTED

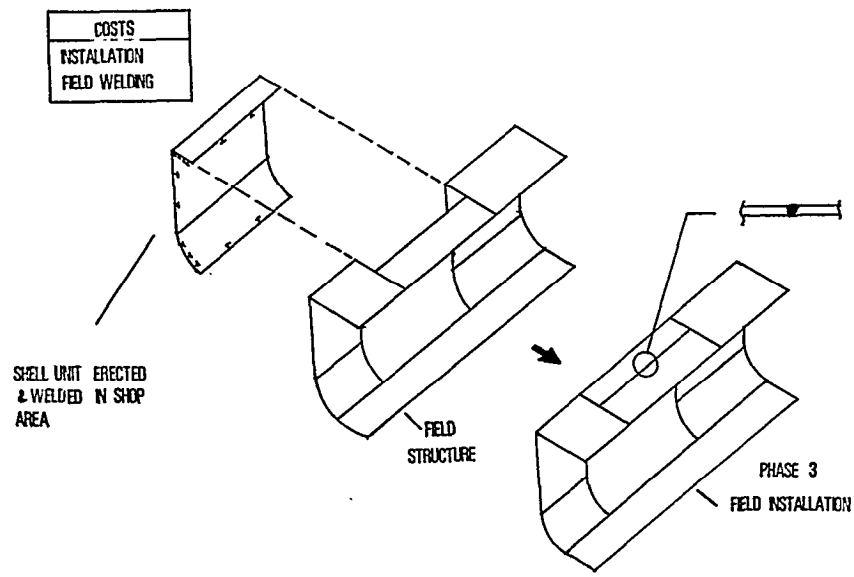


-END STIFFENER CUT
-cutout PLATE.
'STIFFENER BUTTED



-STIFFENER BUTTED
-SAME SIZE

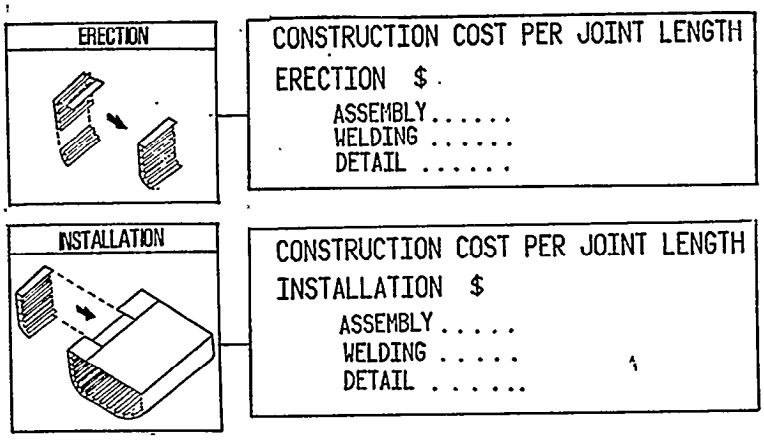
PHASE 3 -FIELD INSTALLATION



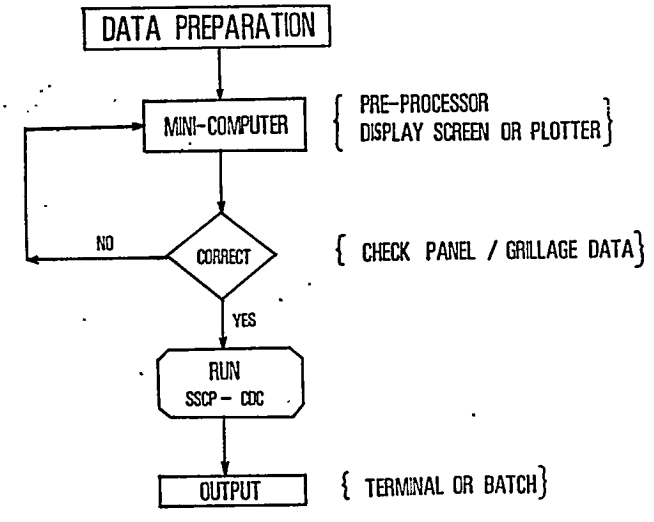
ENGINEERED
UNIFORM METHODS & STANDARDS
TITLE I STRUCTURAL FIELD INSTALLATION

- SHELL
- DECK
- BULKHEADS
- STANCHIONS
- SIDE & WEB FRAMES
- OECKHOUSE
- SHELL UNIT
- BOW UNIT
- STERN UNIT

OUTPUT - PHASE 2-3

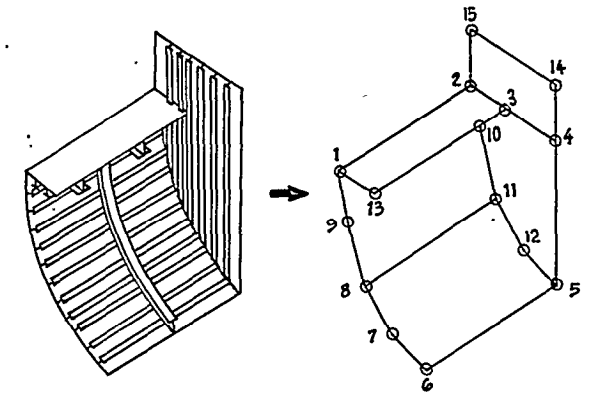


PROGRAM EXECUTION SCHEME



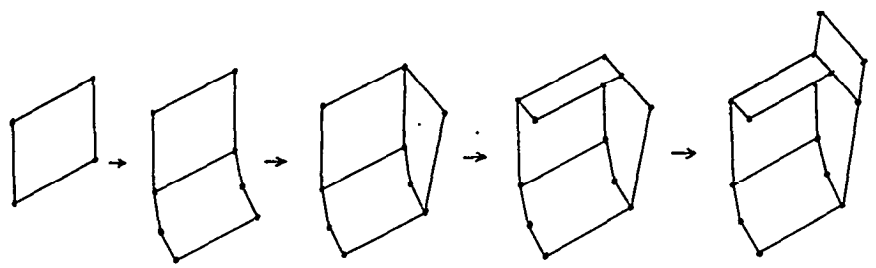
COST MODEL INPUT .DATA

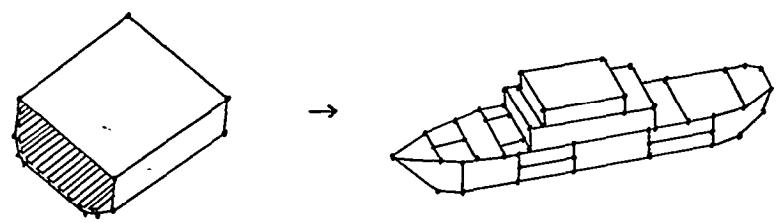
INITIAL DATA
MATERIAL COST
LABOR COST
PANEL DATA
NODES
GEOMETRY
SCANTLNGS
DETALS
WELD INSP.
CONSTR. SEQUENCE
PLATE SIZE CATALOG



SHELL UNIT MODEL

CONSTRUCTION COST MODEL





FUTURE WORK

- AUTOMATED COST/WEIGHT OPTIMIZATION PROGRAM

- DEVELOP COST ESTIMATING TOOL (REPAIR & CONVERSION) FOR NAVAL SHIPYARDS

DEVELOP COST ESTIMATING TOOL (REPAIR & MAINTENANCE) FOR NAVAL SHIPYARD